Revolutionary Stratospheric Platforms for Earth Science Phase I

Meeting Plan and RASC Study Overview

Presentation to RASC Workshop

By Dr. Matthew Kuperus Heun
Global Aerospace Corporation
http://www.gaerospace.com/

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Meeting Agenda

- 8:00–8:30 Registration
- 8:30–8:45 Plan for the RASC study and workshop (Heun)
- 8:45–9:00 Introduction (Wiscombe)
- 9:00–9:40 Overview of stratospheric platforms (Nock)
- 9:40–10:00 Break
- 10:00–10:30 Instructions for breakout sessions (Pankine)
- 10:30–12:00 Begin breakout sessions (all)
- 12:00–13:00 Lunch (group photo, presentations)
- 13:00–14:30 Finish breakout sessions (all)
- 14:30–15:30 Prepare breakout session reports (all)
- 15:30–15:45 Break
- 15:45–17:00 Breakout session reports (Heun, moderator)

Background & Motivation for this RASC Study

- **Significant potential Earth science benefits from stratospheric platforms with**
  - **Long duration (> 100 days)**
  - **Autonomous coordination (data relay, position correction, and notification in the event of problems)**
  - ***In-situ* measurement capabilities**
- **Architecture for such measurements provides unique and challenging opportunities**

Potential Earth Science Applications

- **Atmospheric Chemistry**
  - Few actual profiles of chlorine and bromine (< 1 balloon launch per year)
  - 100-day flight would provide snapshot of evolving stratospheric trace gas structure
- **Earth Radiation Balance**
  - Fluxes at the top-of-the-atmosphere are primary drivers for climate change
  - Satellites measure radiance, not flux
  - Dynamics of the flux (hourly and daily synoptic variation) are unknown
  - 100 platforms around the globe would measure flux directly and provide dynamics
- **Geomagnetism**
  - Non-uniform distribution of existing, land-based observatories
  - Stratospheric platforms could act as proxies for geomagnetism observatory and provide data over oceans
  - Accurate data for mineral and petroleum exploration

Potential Benefits

- **Low-cost, high-altitude (35 km) platform above 99% of Earth's atmosphere**
- ***In-situ* measurements eliminate assumptions inherent in remote sensing of same quantity**
- **Long-life platform provides high accuracy (through averaging) if errors are random**
- **Continuity of long-term climatological observations**
- **Instrument recovery allows post-flight verification**
- **Easy upgrade to new technologies: recover and re-launch**
- **Validation of space-borne instruments**

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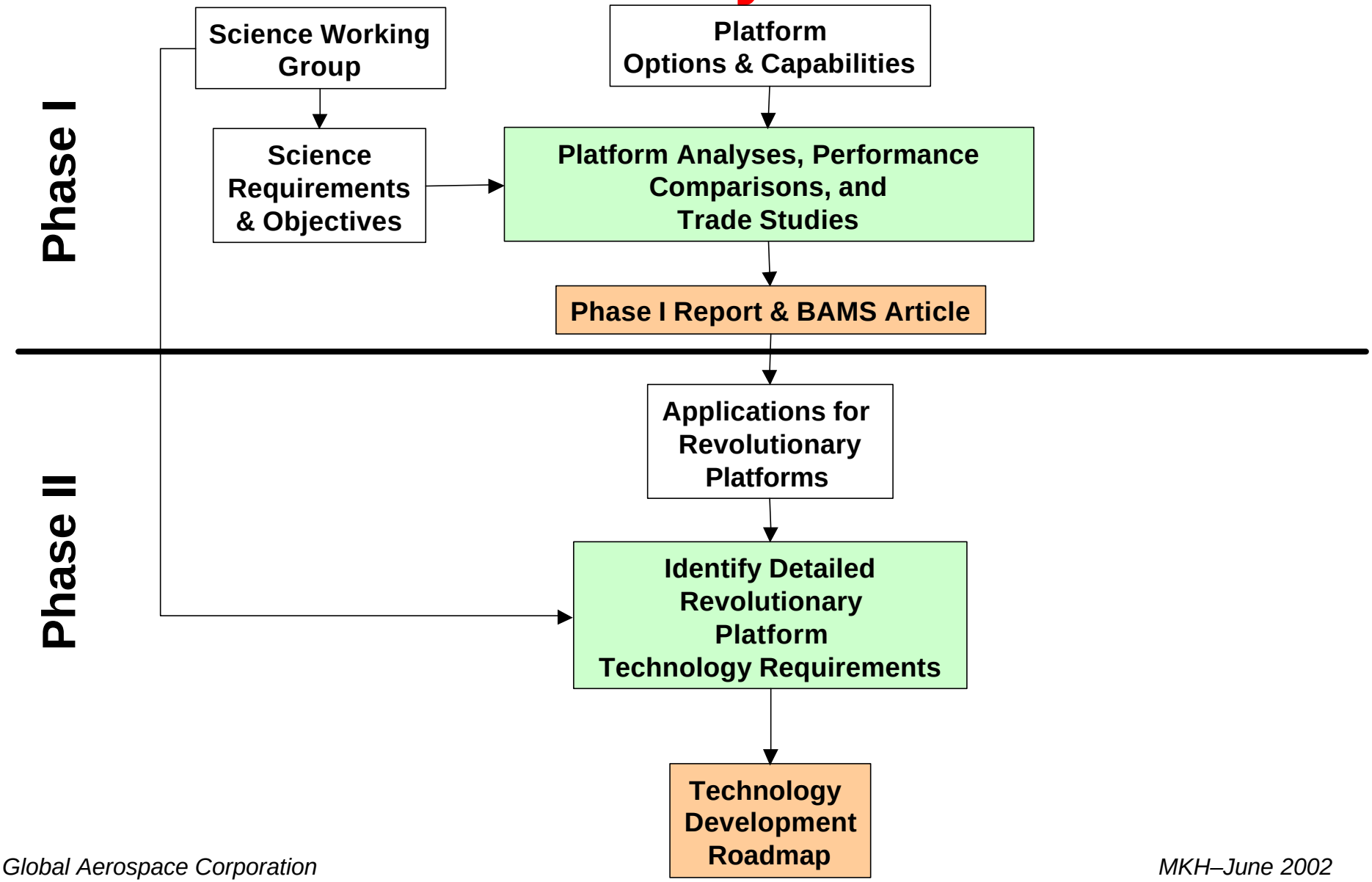
Study Process



Phased Approach

- **Phase I: Evaluate Architecture Options for Earth Science**
  - Systems perspective
  - Examine various platform alternatives
  - Identify strengths of platform systems for meeting science objectives
  - Identify mission applications that deserve further study
  - Completion date: 15 December 2002

- **Phase II: Technology Roadmap**
  - 25 year time frame
  - Infrastructure needs
  - Technology needs
  - Proposal submitted, decision imminent

Study Objectives & Products

- **Objectives**
  - **Phase I: Identify suitable platforms for future revolutionary stratospheric *in-situ* measurements**
  - **Phase II: Roadmap the technologies necessary for the development of such platforms**

- **Phase I products**
  - **Science workshop report**
  - **Written final report**
  - **BAMS article**

Overview of Tasks

- Identify science goals for stratospheric platforms
- Platform identification and comparison
- Platform evaluation
- Reporting

Identify Science Goals

- **Create a 3-person Earth Science Working Group (ESWG)**
  - **One expert from each science discipline area being covered**
  - **Experts develop science concepts, mission options, and science requirements**
- **Convene a science workshop**
  - **ESWG members lead participants for each science area**
    - **Identify ESE strategic plan objectives to be addressed by stratospheric platforms**
    - **Identify measurement requirements, instrument approaches, and science requirements driving platform design**
  - **Develop requirements in several Earth science areas**

Platform Identification and Comparison

- Understand science goals as developed by the Earth Science Working Group and the Earth science workshop
- Access literature and research stratospheric platform systems and concepts
- Develop list of potential stratospheric platforms with required capabilities
- Compare candidate platforms to stated requirements
- Consider both present and future capabilities in RASC context

Evaluate Platforms

- Develop objective stratospheric platform evaluation criteria
- Perform trade studies and independent analysis
- Use scaling models for candidate future platforms
- Evaluate the suitability of each potential platform for meeting science goals and requirements developed at the workshop
- Prioritize potential platforms by their suitability for meeting science goals

Reporting

- Science workshop report
- Written final report
- BAMS article
- Monthly reports
- Weekly tag-ups

The Plan for Today

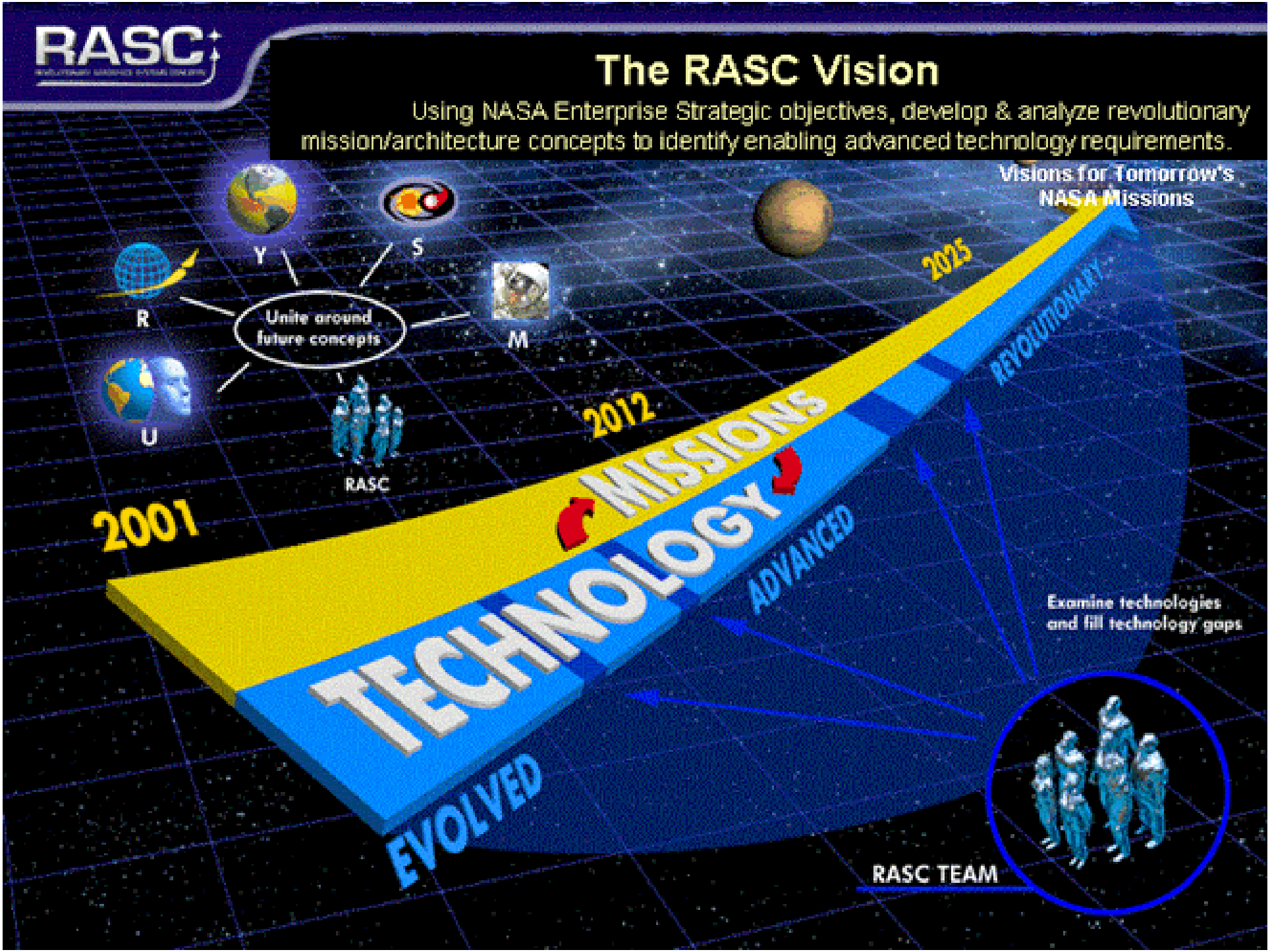
- Develop Earth science mission scenarios
  - Responsive to ESE questions (or future questions)
  - Utilize stated platform characteristics
- Develop measurement strategies
- Develop instrument approaches
- Develop measurement requirements
- Identify potential additional platform requirements
  - Simultaneity with other measurements
  - Multi-platform coordination
  - Trajectories and flight paths
  - etc.

Work Process for Today

- Work in groups
- Use data-capture questionnaire
- Tape recorders
- Scribe for each group
- Develop a written group report
- Reconvene for reports at 15:45

Summary

- **NASA's ESE could benefit tremendously from long-duration autonomously coordinated *in-situ* measurements in the stratosphere**
- **Platform architecture is unique and challenging**
- **Development of the platform architecture would revolutionize Earth science by answering fundamental questions about**
  - **Atmospheric chemistry**
  - **Earth radiation balance**
  - **Geomagnetism**


RASC
The RASC Vision
Using NASA Enterprise Strategic objectives, develop & analyze revolutionary mission/architecture concepts to identify enabling advanced technology requirements.
Visions for Tomorrow's NASA Missions
Y
S
R
M
U
Unite around future concepts
RASC
2001
2012
2025
MISSIONS
TECHNOLOGY
EVOLVED
ADVANCED
REVOLUTIONARY
Examine technologies and fill technology gaps
RASC TEAM

RASC Objectives

- Enable future NASA missions by
  - Developing aerospace systems concepts
  - Technology requirements
- The RASC Program applies a “top-down” perspective to explore new mission capabilities and discover “What's possible”
- Maximize the benefits of revolutionary capabilities that span across NASA Enterprises
- Initial focus: identifying and evaluating revolutionary systems concepts

RASC "Top-Down" Methodology

- Using a 25-year vision perspective, identify the desired new capabilities derived from NASA Enterprise objectives and priorities
- Define integrated systems approaches (architectures) and their required functional capabilities or engineering challenges
- Develop revolutionary systems concepts to provide these capabilities
- Conduct systems trade studies to define the enabling technology requirements and levels of performance needed to meet the challenges
- Recommend the most promising revolutionary concepts with their integrated system payoffs and key enabling technology requirements